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AUTHOR Wetzel, Sandra K.; And Others
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ABSTRACT

Surveys and follow-up interviews were conducted in 1978 and 1980 respectively at the Navy's Instructional Program Development Centers to determine the need for the development or modification of authoring aids (manuals containing detailed procedural guidelines) to support designers/developers in producing high quality, usable instructional materials. In addition, tri-service availability and utilization of authoring aids were assessed. Results indicated that instructional strategy selection, terminal/enabler objective writing, and test construction needed support. The tri-service assessment showed that existing aids and those under development would require major modifications to meet Navy requirements. It was recommended that: (1) designers/developers be encouraged to take courses/workshops in instructional technology; (2) coordination be maintained with appropriate tri-service agencies for interservice exchange, and (3) existing authoring aids, such as the Instructional Quality Inventory (IQI) and the Author Training Course, be modified if necessary and placed online as computer-based aids. A 24-item bibliography, a flow chart outlining Instructional Systems Development (ISD) design and development tasks, and a report distribution list are provided. (Author/ESR)

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THE STATUS OF AUTHORING AIDS FOR INSTRUCTIONAL SYSTEMS DEVELOPMENT: AN ANALYSIS OF NEEDS AND AVAILABILITY

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San Diego, California 92152

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THE STATUS OF AUTHORING AIDS FOR INSTRUCTIONAL SYSTEMS DEVELOPMENT: AN ANALYSIS OF NEEDS AND AVAILABILITY

Sandra K. Wetzel
John A. Ellis
Wallace H. Wulfeck, II
William E. Montague

Reviewed by
John D. Ford, Jr.

Released by
James F. Kelly, Jr.
Commanding Officer

IR011102

Navy Personnel Research and Development Center
San Diego, California 92152

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Surveys were conducted at the Navy's Instructional Program Development Centers to determine the need for the development or modification of authoring aids to support designers/developers in producing high quality, usable instructional materials. In addition, tri-service availability and utilization of authoring aids were assessed. Results indicate that instructional strategy selection, terminal/enabler objective writing, and test construction need support. The tri-service assessment showed that existing aids and those under development would require major modifications to meet Navy requirements. It was

recommended that (1) designers/developers be encouraged to take courses/workshops in instructional technology, (2) coordination be maintained with appropriate tri-service agencies for interservice exchange, and (3) existing authoring aids, such as the Instructional Quality Inventory and the Author Training Course, be modified if necessary and placed on-line as computer-based aids.

FOREWORD

This research and development was performed within subproject Z1175-PN.05 (Improved Effectiveness in Course Design, Delivery, and Evaluation) and under the sponsorship of the Deputy Chief of Naval Operations (Manpower, Personnel, and Training) (OP-01). The objective of the subproject was to develop an empirically-based instructional design support system to aid developers in choosing instructional alternatives based on cost/benefits and specific resource limitations. The purposes of the effort described herein were to identify the problems that authors at the Navy's Instructional Program Development Centers (IPDCs) had in using the Instructional Systems Development model for developing instruction, determine what authoring aids were available or needed to assist them in developing instructional materials, and assess tri-service availability and utilization of authoring aids.

Results are intended for use by the Chief of Naval Education and Training (specifically, the IPDCs) and the Chief of Naval Technical Training.

JAMES F. KELLY, JR.
Commanding Officer

JAMES W. TWEEDDALE
Technical Director

SUMMARY

Problem

Instructional development in the Navy's Instructional Program Development Centers (IPDCs) is guided by the Interservice Procedures for Instructional Systems Development (ISD). Recent studies on the use of the ISD model for instructional development suggest that ISD does not provide complete enough guidance for relatively inexperienced authors who design and develop training programs. More experienced personnel are not readily available to the Navy and the cost of upgrading instructional skills of the present IPDC staff would be very expensive. However, before the present ISD process can be improved, specific information is needed about the difficulties encountered in authoring instruction.

Objectives

The objectives of this effort were to (1) identify the problems that authors at IPDCs have in implementing the ISD model, (2) determine what other authoring aids exist that could be used to assist authors in developing instructional materials, (3) assess the need for additional aids at the IPDCs, and (4) assess tri-service availability and utilization of authoring aids.

Approach

This effort was conducted in two phases. In the first phase, conducted in 1978, a structured questionnaire was developed and administered to IPDC staff members to determine if they believed that existing procedures were adequate for instructional development. Two approaches were used in the second phase, which was conducted 2 years later after IPDC personnel had increased experience in the use of the ISD process. First, to extend results of the questionnaire administered during Phase 1, IPDC personnel were extensively interviewed to obtain more detailed information regarding difficulties encountered in developing training using the ISD process. Second, tri-service agencies were contacted to determine what authoring aids were available, whether they recognized the need for authoring aids, and whether any were being developed.

Results

Questionnaire responses from Phase I revealed that improved or new techniques were needed in four areas: (1) methods for evaluating appropriateness of training objectives, (2) methods for developing tests and test items, (3) procedures for evaluating objective quality, and (4) quality control procedures for the instructional development process.

These results helped define R&D needs and led to the development of the Instructional Quality Inventory (IQI) as an aid for design and development. The individual interviews held in Phase 2 revealed that, although some of the problems uncovered in Phase 1 had been dealt with fairly adequately by IQI, problems still existed in (1) selecting instructional strategies, (2) acquiring knowledge about the subject matter, (3) writing terminal and enabling objectives, (4) writing test items, and (5) adhering to the ISD model because of time and system constraints. In addition, information was obtained about the education and experience level of IPDC authors.

Contacts with tri-service agencies revealed that authoring aids being developed were (1) service specific, (2) still in the development stage, and (3) not ready for modifications that would meet Navy application needs.

Conclusions

Development of instructional materials and test construction were difficult areas for most IPDC authors using ISD procedures. In view of the complexity and length of training needed to provide skilled instructional designers, and the lack of such people among the IPDCs, improved guidance is needed for the process of materials development.

Recommendations

1. Authoring aids already available, such as the IQI and the Navy's Author Training Course, should be adapted for use as on-line computer-based aids.

2. NAVPERSRANDCEN should develop an author-aiding system that utilizes existing aids and incorporates new ones as needed. The system should be transportable so that it can be widely utilized by groups developing Navy instruction in various locations. It would be available for tri-service utilization.

3. IPDC staff members should be strongly encouraged to take advantage of available instructional technology courses and, whenever possible, time should be set aside for this training.

4. Coordination should be maintained with the appropriate tri-service agencies to facilitate interservice exchange, as well as eventual application of new authoring aids.

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INTRODUCTION

Problem and Background

The Navy depends heavily upon its training system to provide personnel who are fully equipped to handle the high technology requirements of the modern Navy. The training system, in turn, relies upon performance-based instruction, which is derived from job specification and training analysis. Appropriate instructional procedures are then developed to prepare students to meet job requirements.

Instruction for a variety of Navy technical schools is developed and revised by the Instructional Program Development Centers (IPDCs), San Diego and Great Lakes (later Memphis and Pensacola), which were established as central instructional organizations by the Naval Education Training Command in 1976. Developing and revising instructional programs is a complicated process that requires either highly educated and experienced designers and developers or, alternatively, a set of "complete" guidelines that enables less experienced persons to do the work (Hodak, Middleton, & Rankin, 1979; Miller, Swink, & McKenzie, 1978). Since highly educated and experienced designers and developers are rare, the Interservice Procedures for Instructional System Development (ISD) (Branson, Rayner, Cox, Furman, King, & Harnum, 1975) were designed and developed to serve as the basis for instructional development in the three services. The ISD model is, in effect, a design aid describing what has to be done and was intended to provide guidance for how to do it. One of the implicit assumptions behind its adoption by the services is that techniques and procedures needed to develop instruction are specified in a way that allows military subject matter experts (SMEs) with little or no background in education or instructional technology to design training materials.

The ISD model is an application of the systems analysis approach to training. This approach was first applied to training development in the 1950s (Churchman, 1968). Developers who were familiar with the development procedures and had extensive knowledge about the effectiveness of various training methods prepared guidelines that would enable others to use these procedures and methods. The notion underlying the development of these guidelines, which were intended to provide specific, step-by-step procedures for designing and developing instruction, was that standardized output of good, usable instruction would result.

However, recent studies on the use of the ISD model for instructional development suggest that ISD procedures do not provide untrained, inexperienced personnel with enough guidance through the design/development process or at the critical decision points to guarantee good instructional program development (O'Neal, Faust, & O'Neal, 1979). For example, Vineberg and Joyner (1980), as well as Hodak et al. (1979), studied the institutionalization of ISD and found that the procedures were difficult to use, as well as unreliable. Too much is still left up to the individual author in translating ISD from a series of "what to do" steps to an integrative process of instructional development (Montmerlo & Tennyson, 1976; Montmerlo, 1979). Further, in empirical evaluations of the implementation of the ISD process in the military, significant problems were found (e.g., guidance was incomplete, steps were difficult to relate to one another, and job analyses were incomplete) (Vineberg & Joyner, 1980; Rickertson, Schultz, & Wright, 1970; Hodak et al., 1979; Miller et al., 1978). Also, recent examination of implementation problems in education suggest that a serious problem in effecting innovations in teaching practice is the lack of control over the details of implementation (i.e., the lack of quality control, monitoring systems, and effective, easy to use guidelines) (Aagard & Braby, 1976; Bunderson, 1977; Lipson, 1973; Van Pelt & Rich, 1975).

At the time of this research, many of IPDC's civilian instructional technologists, who were expected to develop and maintain expertise in curriculum design and development, were relatively inexperienced, and their rate of turnover was high. Further, the ISD procedures designed to guide the instructional development process appeared to be incomplete and allowed variability (cf. Rickertson et al., 1970). More experienced personnel are not readily available to the Navy and the cost of upgrading instructional skills of the IPDC staff would be very expensive. Therefore, procedures must be refined and developed to reduce the variability allowed by the present design and development guidelines.

One possible solution could be to revise or develop new automated aids that would more adequately support relatively inexperienced authors in producing instructional materials as well as provide a method for assuring quality control in the implementation phase. Another would be to provide improved training for authors to upgrade their skills in developing instructional materials. However, before the present ISD process can be improved, specific information is needed about the difficulties authors encounter and the type of authoring aids that are available.

Objectives

The goals of this effort were to (1) identify problems authors at the IPDCs have in implementing the ISD model, (2) determine what authoring aids in addition to ISD are being or could be used to assist authors in developing instructional materials, (3) assess the need for additional aids for use at the IPDCs, and (4) determine tri-service availability and utilization of authoring aids.

METHOD

This effort was conducted in two phases. In the first phase, conducted in 1978, the ISD procedures in use at the IPDCs were reviewed and a flowchart made of the activities, personnel responsibilities, and information flow in the ISD design and development phases (Phases II and III) (see appendix). In the process of producing the flowchart, 14 design and development tasks or decisions critical to the success of the overall procedures were identified. These 14 areas were used to construct a structured questionnaire designed to determine if the existing procedures in these areas were adequate or if new procedures should be developed. The questionnaire was administered to 57 development personnel--32 at IPDC San Diego and 25 at IPDC Great Lakes.

The second phase was conducted in 1980, after IPDC personnel had increased their experience in the use of the ISD process. In this phase, issues were considered that were related to the adequacy of ISD procedures and the need for revision or development of additional authoring aids. These issues were (1) authoring procedures currently in use at the IPDCs, and (2) an assessment of tri-service utilization of authoring aids.

To assess the authoring procedures then in use and to determine potential training requirements, extensive interviews were conducted with IPDC personnel at San Diego and Great Lakes who were very familiar with both the ISD model and the problems with the model at IPDC. This included members of the administrative staff, designers, writers, and editors. This effort extended the results of the structured questionnaire administered to IPDC staffs during Phase I.

The areas of concern in these interviews were (1) authoring aids currently in use, (2) education/experience levels of authors at IPDC, and (3) problem areas in curriculum development. Several questions needed to be answered in these areas before training recommendations could be made. To reduce bias due to individual perception, information gained during the interviews was confirmed with at least three other interviewees before being included in this study. Recommendations concerning the requirements for additional authoring aids needed to support specific blocks in the ISD model were then formulated.

To determine what authoring aids were available and in use, a survey was made of the appropriate agencies in the Army, Air Force, and Navy. Civilian contractor firms working on government contracts in instructional development were also surveyed.

RESULTS

Phase 1

Table 1, which presents questionnaire results, shows that the majority of respondents indicated that new or improved procedures would be useful in 13 of the 14 areas (all but No. 5, which was reported as "not applicable" by 26% of the respondents). The areas identified as most in need of new or improved methods were (1) methods for evaluating the appropriateness of training objectives (No. 1), (2) methods for developing tests and test items (No. 2), (3) procedures for evaluating objective quality (No. 8), and (4) quality control procedures for the instructional development process (No. 13). The objective adequacy assessment portion of the IQI (Wulfeck, Ellis, Richards, Merrill, & Wood, 1978; Ellis, Wulfeck, & Fredericks, 1979) partially addresses the first three areas listed and completely covers the latter one.

IPDC personnel identified a need for comprehensive procedures for making decisions about testing and for writing criterion-referenced test items that are consistent with objectives. Vineberg and Joyner (1980), in their review of ISD, also identified the need for better test development procedures. They recommended that "ISD models should be expanded to provide procedures for identifying and maintaining congruence (i.e., consistency) between the behavioral requirements of objectives and test items."

Phase 2

Authoring Procedures Used at the IPDCs

Authoring Aids Currently in Use. The IPDC staffs at Great Lakes and San Diego agreed that existing authoring aids did not provide adequate guidance for producing standardized and usable instructional materials. At the time of this effort, there were four primary aids that provided some degree of guidance for instructional program development. (These are still the primary guidance documents.)

1. NAVEDTRA 110 (CNET, 1979), a procedures manual that was designed primarily for use by management in monitoring steps in the instructional process rather than to provide guidance in design and development.[1]

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[1] A substantial revision of this manual was undertaken in 1981. This revision includes more guidance for design and development.

Table 1

Responses of IPDC Personnel to Questionnaire on Need for Improved ISD Procedures

Area	Percent Responding					N
	Not applicable	Current procedures are adequate	No need for this	Probably useful	Extremely useful, would use it now	
1. More systematic methods for evaluating the appropriateness of objectives for developing training materials.	5.26	1.75	0	36.85	56.14	57
2. Methods for developing test items from objectives, including performance tests.	5.26	5.26	1.75	33.33	54.40	57
3. A test specification plan including item format, number of items, and test writing instructions.	7.15	5.35	7.15	48.21	32.14	56
4. Procedures for making tests diagnostic, or methods for developing diagnostic tests.	9.09	3.65	9.09	40.00	38.17	55
5. Methods for deciding whether entry tests and pretests are cost effective.	26.32	3.51	21.05	24.56	24.56	57
6. Methods for sequencing and structuring objectives.	8.93	7.14	1.78	35.72	46.43	56
7. Procedures for planning the management of instruction:						
a. Structuring the course into lessons and modules.	12.28	14.04	1.75	45.61	26.32	57
b. When to test and how much to test.	10.53	8.77	5.26	38.60	36.84	57
c. Managing or controlling student progress.	17.54	10.53	5.26	43.86	22.81	57
d. Cost-effectiveness of different management options.	24.57	1.75	5.26	36.84	31.58	58
8. A procedure for evaluating the quality of objectives.	1.85	5.56	0	31.48	61.11	54
9. More systematic procedures for specifying to authors what should be included in a lesson; for example, kinds and numbers of examples, practice items, etc.	9.26	5.56	9.26	35.19	40.74	54
10. Criteria for deciding among types of instructional media.	9.09	25.46	7.27	32.73	25.45	55
11. Media for evaluating existing materials, and ways to decide if it is worth revising them.	3.70	9.26	5.56	35.20	46.29	54
12. More systematic procedures for writing instruction.	9.26	7.41	7.41	33.33	42.59	54
13. Quality control methods for the instructional development process.	0	5.56	1.85	35.19	57.41	54
14. Methods for validating instruction from student trials.	12.96	16.67	1.85	44.44	24.08	54

2. NAVEDTRA 106A (Branson et al., 1975), the Navy's ISD manual, which was designed to provide guidance specific to ISD procedures at the designer/developer level. This manual, as well as NAVEDTRA 110, is lengthy and somewhat cumbersome. Also, some of the guidance contained therein is incomplete.

3. The IQI (Wulfeck et al., 1978), which is relatively short and has a workbook that orients the writer to the IQI concepts and provides practice in using those methods (Ellis, Wulfeck, & Fredericks, 1979).

4. The Author Training Course (ATC) (NAVEDTRA 10003), which was designed as a series of self-instructional manuals for the development phase of ISD. Although a few IPDC staff members had attended a workshop, such ATC workshops were not offered in a systematic manner nor were they available to the entire staff. Individual staff members had found various tests and manuals that provided some guidance, but neither the authoring aids nor the training were available to the staff generally. Finally, since there was no specific training or skill-updating schedule for the staff, additional skills were acquired only through personal motivation (i.e., additional coursework, information sharing between staff, pertinent reading).

Education/Experience. One of the problems at the IPDCs was the wide variability in the staff members' technical preparation for designing/writing instruction. Only a few staff members had specialized, advanced training in instructional design. For example, at one IPDC surveyed, most of the basic staff consisted of English, linguistics, and education majors, and retired journalists and teachers. Approximately 60 to 70 percent of the designers/writers were young with Bachelor or Master of Arts degrees, and many of these were in their first professional job. There were also a number of retired military who had been classified as education specialists, and a few active duty military who received an ISD orientation upon their arrival at IPDC.

Most of the staff were introduced to instructional design, job/task analysis, and writing of instructional materials by on-the-job training at IPDC. Given this lack of specific training in ISD and the paucity of author training aids available for use, the training of incoming staff had relied almost totally upon information, tools, and techniques provided by the more experienced staff members. This condition produced nonstandardized approaches to the analysis, design, and production of materials.

At each IPDC, there was an evaluation group tasked with standardizing the curriculum output, as well as a separate editorial staff tasked with standardizing writing styles. However, because of the general lack of training in basic instructional design and writing, the initial output tended to be relatively poor, requiring extensive rewrite and even redesign before a final version of the curriculum could be produced. As a result, the evaluation staff was overburdened.

Problem Areas in Curriculum Development. The IPDC staff members interviewed felt that writers/developers needed training in several areas. Probably the most significant area of concern was the selection and development of instructional strategies (i.e., the ways in which the content is arranged and presented to teach to the course objectives). System constraints within IPDC and at the instructional site limited choices of how best to teach the materials. These contraints included the costs of audiovisual instructional media (films, slides, etc.), availability of simulated equipments, and availability of tools and materials needed for hands-on training, as well as internal IPDC problems of personnel, graphics requirements, and availability of SMEs. There was, however, another problem at the IPDC staff level in selecting the appropriate instructional strategy (within the known constraints) for satisfactorily teaching the required job

performance: The ability to select appropriate strategies was somewhat restricted by the limited knowledge about instructional development held by most of the staff members. For example, because the use of graphic illustrations as an instructional tool was not well understood by the staff, many instructional strategy decisions were made without considering the entire range of possibilities.

The difficulties found in selecting appropriate instructional strategies were further complicated by lack of knowledge about the subject area. Designers/writers relied heavily upon individual SMEs and the curriculum from the existing course for the required knowledge. Before and during the development of the instructional materials, the designer reviewed the previous course material, assisted by (usually) a single SME. The problem for the designer was how to use this SME effectively in determining what should be in the course. The process of extracting valid information from an SME is both critical and complicated. Depending upon the technical level of the course requirements, incomplete understanding of the relationship between critical tasks and job performance can lead to oversimplification, incorrect prioritization of critical tasks, and poorly defined terminal objectives. Although the ISD analysis phase is supposed to define tasks adequately, feedback from designers, writers, and evaluators indicated that this was a problem area.

There was general consensus among those interviewed that personnel required further training in writing terminal and enabling objectives. Although some training had been given in this area, apparently either the examples in texts and workshops were not applicable to the IPDC environment, or the teaching was not adequate enough to enable the authors to transfer the knowledge to their work. It was suggested that a workshop be structured around course material in which development problems had been encountered so that the workshop would be more relevant to the IPDC. In addition, there was apparently some difficulty in understanding the relationship between enabling objectives and the terminal objective.

Training in writing test items was also needed. At the time of the interviews, there was no expert in test construction on the IPDC staff. The type of test used to assess performance in IPDC-developed instructional programs is called a criterion-referenced test. In such tests, an individual's performance is compared (referenced) to an absolute standard or criterion of what a person must know or be able to do. Specific training in scoring and interpretation of test results is required for making appropriate decisions about student performance.

The criterion-referenced test is very different from the better known and more commonly used norm-referenced test, in which each student's performance is compared and ranked relative to the performance of other students. Norm-referenced tests are used to help make decisions about promotions, about college entrance examinations, and in other situations where the aim is either to select the best possible students above a cutoff line or to fill a single job opening. Since the object in a training situation is to train all students to a specific performance objective rather than to select a given percentage, the most positive outcome of a training environment would be to have 100 percent of the students meet the performance objective. In addition, there is no separate norming or evaluation of the tests; the tests are validated at the same time as the course materials, because of such system constraints as lack of student subjects, time, and staff experts to evaluate the results.

When questioned about the degree of adherence to the ISD model in terms of completeness and sequence, respondents indicated that the model was not strictly followed. The main reason seems to be that various components in the Navy system do

not allow it. For example, the design phase was often begun before CNET approval of the ISD analysis was obtained. Design decisions were made on the basis of logical guesswork that predicted the most likely material to be included in the final package. Since these decisions affected the construction of the next ISD steps, a considerable amount of redesign would have been required if the predicted and approved final packages differed significantly.

Another system constraint was the fact that IPDC did not have final control over all of the resources it used. This lack of control required a certain amount of flexibility in following the sequence of the ISD model. For example, SME assignments and procurement of needed field equipment were not under IPDC jurisdiction. The particular timing of their availability influenced the sequence of tasks. In addition, procurement procedures frequently resulted in delays in acquisition of planned audiovisual or other training materials, which may have caused changes in the original instructional design. In summary, the ISD model was often compromised by both economic and logistical contraints.

Assessment of Tri-service Utilization of Authoring Aids

Initial contacts with appropriate agencies in the three services indicated that, although they were interested in the author aid development problem, there was limited coordination of efforts among groups. The Air Force Human Resources Laboratory had developed a research and development plan, but funding cuts had all but eliminated their participation. However, under contract, authoring support software was developed. With this software, simulation scenarios could be prepared using conversational dialogue instead of a programming language so that the authoring system could be used by personnel not fluent in computer programming. Also, computer-based decision aids for writing learning objectives were developed.

In the Navy, the Navy Personnel Research and Development Center (NAVPERS-RANDCEN) began the development of computer-based aids for instructional design in 1982. The first phase of this effort is intended to help designers at critical points in the ISD process by guiding and monitoring each step involved in using the IQI and in developing tests. Programs will then be expanded gradually to provide specific guidance on accomplishing each task, allow access to relevant data bases (e.g., test-item files, classifications of objectives, etc.), and help select alternative forms of instruction.

Another Navy system, which is being developed by the Navy Training Analysis and Evaluation Group (TAEG), can be used by authors who are SMEs to write, edit, and produce programmed training materials (Braby, 1979). In this system, the author types requests for information about materials and test items on a terminal that is connected to an editing and production system. The system then arranges the material in a format appropriate for programmed instruction and produces the text. Not only is the time required for authoring and producing materials reduced but also, and more importantly, the requirements for instructional design expertise. Such systems will enable personnel with only modest experience in instructional design and development to develop quality instructional materials.

Two major efforts were being conducted under contract to the Army Research Institute (ARI). The first is focused on completing off-line aids for all blocks in the ISD model (Schultz, Hibbits, Wagner, & Seidel, 1979). However, since all of these aids are Army military occupation specialty (MOS) specific, they are not readily applicable to tri-service needs. The second effort, which is being monitored by the ARI Field Unit located at Ft. Bliss, concerns the development of a five-part model of a computer-based authoring

aid. The five parts are (1) Training Prescription, (2) Training Hierarchy, (3) Cost Partition, (4) Test Analysis Partition, and (5) Training Characteristics Partition. With this model, an author can input information, and the computer will supply a training hierarchy that includes media method selection and training criticality.

DISCUSSION AND CONCLUSIONS

It is clear from the results of both phases of this effort that there were problems in the implementation of ISD. Results from the structured questionnaire administered during Phase 1 indicated that the areas most in need of improved or new authoring aids were (1) methods for evaluating the appropriateness of training objectives, (2) methods for developing tests and test items, (3) procedures for evaluating objective quality, and (4) quality control procedures for the instructional development process. The results from Phase 2, conducted 2 years later, showed that some of the previous problems had been dealt with fairly adequately by using IQI (particularly those with quality control procedures). However, IPDC staff members noted that additional aids were needed in the areas of (1) instructional strategy, (2) depth of subject area knowledge, (3) media selection, (4) terminal/enabler objective writing, and (5) test construction.

Since the area of test construction, which was identified as a problem area in both phases, appeared to be a very difficult area for the staff at the IPDCs, NAVPERSRAND-CEN has developed an improved test development procedures. The results of the effort are included in a handbook of "job-aids" for Navy test developers that is being compiled from a variety of sources (Merrill & Wood, 1974; Swezey & Pearlstein, 1974; Roid & Haladyna, 1979; Frederickson, Smith, & Pearlstein, 1979). The handbook was refined during training workshops for Navy personnel and a final version was forwarded to CNET in FY82.

The level of education and experience of IPDC staff members was less than optimal for producing high-quality instructional materials. The fact that in-service training had been placed on a much lower priority than product output made it difficult for the authors to upgrade their writing/developing skills.

There are a variety of training solutions that could be effective in overcoming the training problems identified at IPDC. Those potential solutions include intensive training of the IPDC staff in instructional technology, developing new authoring aids, or automating existing authoring aids. A system of computer-based authoring aids could facilitate the design and development phases of the ISD process by providing specific guidance to authors as they progress through each ISD block (Taylor, 1979). Moreover, computer-based systems have the unique capability of ensuring that guidance is followed by monitoring, evaluating, and providing feedback to individual authors at the point in the development cycle that is most useful to them. In addition, the utilization of computer-based aids and other on-line author training materials would allow authors to integrate additional training into their schedules more easily.

As stated earlier, the assessment of tri-service availabiity and utilization of author aids showed mutual interests and coordination. However, this coordination has been limited to an exchange of information rather than specific planning toward product transferability. Although some promising R&D efforts are being accomplished by each of the services, the authoring aids being developed are (1) service-specific, (2) still in the development stages, and (3) not ready for modifications that would meet Navy application needs. Although the Army is probably closest to having a usable author aid for ISD

program development, it is not clear at this point whether these aids will provide sufficient guidance to inexperienced authors.

RECOMMENDATIONS

1. To take advantage of those training design strategies that are known to be cost effective, those authoring aids already available, such as IQI and the Navy's Author and Training Course, should be modified if necessary and placed on-line as computer-based aids.

2. NAVPERSRANDCEN should develop an author-aiding system that utilizes existing aids and incorporates new ones as needed. The system should be transportable so that it can be widely used by groups developing Navy instruction in various locations. It should be available for tri-service utilization.

3. IPDC staff members should be strongly encouraged to take advantage of available instructional technology courses and, whenever possible, time should be set aside for this training.

4. Coordination should be maintained with the appropriate tri-service agencies to facilitate interservice exchange, as well as eventual application of new authoring aids.

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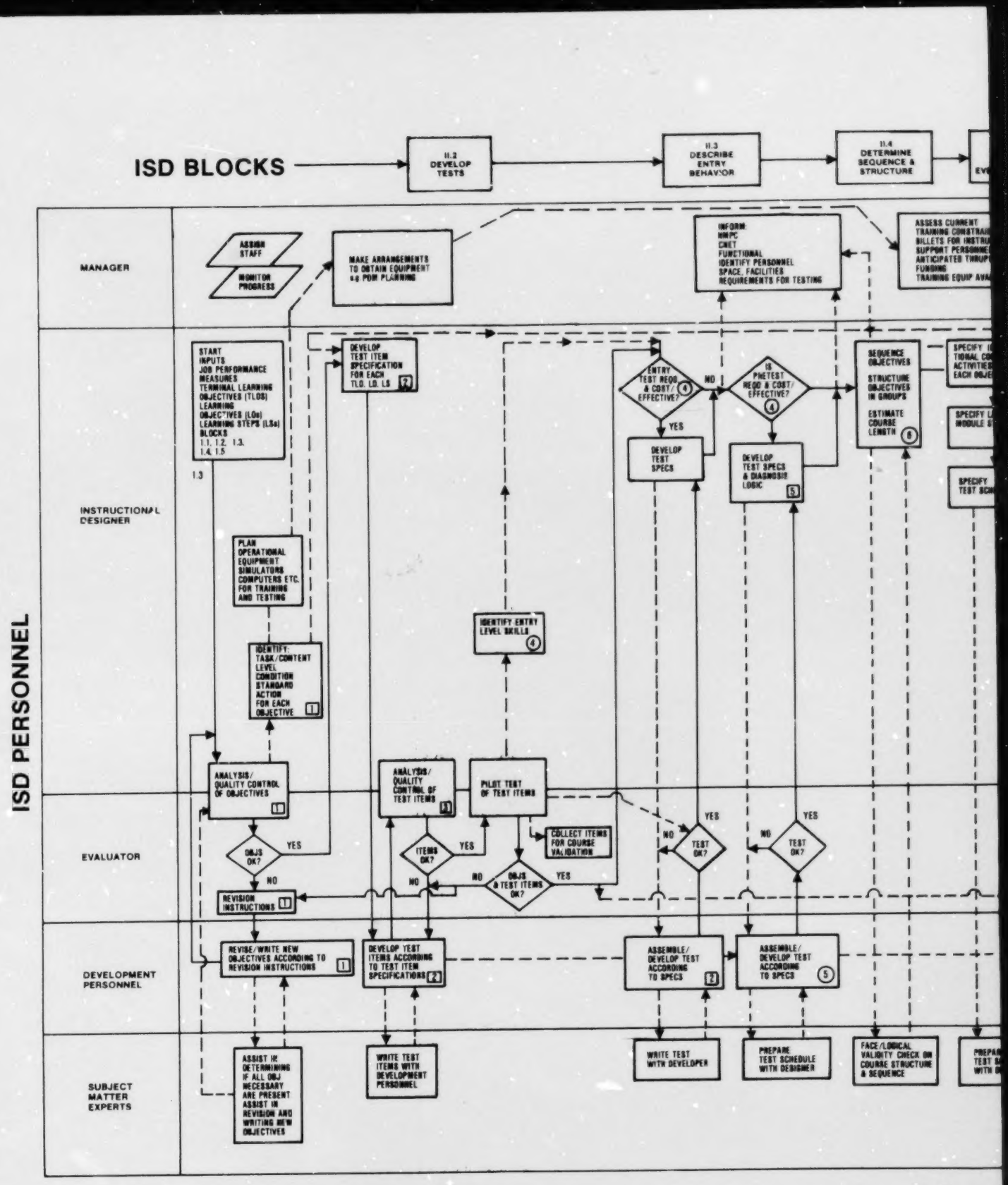
APPENDIX

ISD DESIGN AND DEVELOPMENT TASKS


ISD BLOCKS
II.2 DEVELOP TESTS
II.3 DESCRIBE ENTRY BEHAVIOR
II.4 DETERMINE SEQUENCE & STRUCTURE
ISD PERSONNEL
MANAGER
ASSIGN STAFF
MONITOR PROGRESS
MAKE ARRANGEMENTS TO OBTAIN EQUIPMENT e.g. POM PLANNING
INFORM: NMPC CNET FUNCTIONAL IDENTIFY PERSONNEL SPACE, FACILITIES REQUIREMENTS FOR TESTING
INSTRUCTIONAL DESIGNER
START INPUTS JOB PERFORMANCE MEASURES TERMINAL LEARNING OBJECTIVES (TLOS) LEARNING OBJECTIVES (LOs) LEARNING STEPS (LSs) BLOCKS I.1, I.2, I.3, I.4, I.5
I.3
DEVELOP TEST ITEM SPECIFICATION FOR EACH TLO, LO, LS
ENTRY TEST REQD & COST/ EFFECTIVE?
NO
YES
IS PRETEST REQD & COST/ EFFECTIVE?
SEQUENCE OBJECTIVES
STRUCTURE OBJECTIVES IN GROUPS
ESTIMATE COURSE LENGTH
DEVELOP TEST SPECS
DEVELOP TEST SPECS & DIAGNOSIS LOGIC
PLAN OPERATIONAL EQUIPMENT SIMULATORS COMPUTERS ETC. FOR TRAINING AND TESTING
IDENTIFY: TASK/CONTENT LEVEL CONDITION STANDARD ACTION FOR EACH OBJECTIVE
IDENTIFY ENTRY LEVEL SKILLS
EVALUATOR
ANALYSIS/ QUALITY CONTROL OF OBJECTIVES
OBJS OK?
YES
NO
REVISION INSTRUCTIONS
ANALYSIS/ QUALITY CONTROL OF TEST ITEMS
ITEMS OK?
PILOT TEST OF TEST ITEMS
OBJS & TEST ITEMS OK?
COLLECT ITEMS FOR COURSE VALIDATION
TEST OK?
DEVELOPMENT PERSONNEL
REVISE/WRITE NEW OBJECTIVES ACCORDING TO REVISION INSTRUCTIONS
DEVELOP TEST ITEMS ACCORDING TO TEST ITEM SPECIFICATIONS
ASSEMBLE/ DEVELOP TEST ACCORDING TO SPECS
SUBJECT MATTER EXPERTS
ASSIST IN DETERMINING IF ALL OBJ NECESSARY ARE PRESENT ASSIST IN REVISION AND WRITING NEW OBJECTIVES
WRITE TEST ITEMS WITH DEVELOPMENT PERSONNEL
WRITE TEST WITH DEVELOPER
PREPARE TEST SCHEDULE WITH DESIGNER
FACE/LOGICAL VALIDITY CHECK ON COURSE STRUCTURE & SEQUENCE

A-1/A-2

III.1 SPECIFY LEARNING EVENTS/ACTIVITIES

III.2 SPECIFY INSTRUCTION MANAGEMENT PLAN & DELIVERY SYSTEM

III.3 REVIEW/SELECT EXISTING MATERIALS

III.4 DEVELOP INSTRUCTION

III.5 VALIDATE INSTRUCTION

ASSESS CURRENT
TRAINING CONSTRAINTS
BILLETS FOR INSTRUCTORS
SUPPORT PERSONNEL
ANTICIPATED THRUPUT
FUNDING
TRAINING EQUIP AVAILABILITY

PERSONNEL ASSIGNMENTS
MEDIA ALLOCATION/
PROCUREMENT
SYSTEM MASTER PLAN

ASSIGN PERSONNEL
BUDGET FOR
DEVELOPMENT

PROCURE STUDENTS
FOR TRYOUT
OF MATERIALS

SPECIFY INSTRUCTIONAL CONDITIONS, ACTIVITIES FOR EACH OBJECTIVE (7)

SPECIFY LESSON MODULE STRUCTURE (8)

SPECIFY TEST SCHEDULE (9)

IDENTIFY INSTRUCTIONAL MANAGEMENT OPTIONS

CONDUCT COST/BENEFITS ANALYSIS

SPECIFY INSTRUCTIONAL MANAGEMENT PLAN (10)

SELECT MEDIA TYPES REQUIRED FOR LEARNING ACTIVITIES

CONDUCT COST/BENEFITS ANALYSIS OF SPECIFIC MEDIA OPTIONS WITHIN TYPES

SELECT MEDIA FOR TRAINING (11)

DEVELOP TEST SPECS AND DIAGNOSTIC LOGIC INCLUDING DELIVERY SYSTEM EQUIPMENT REQUIREMENTS (5)

TESTS OK? YES NO

ASSEMBLE/DEVELOP TESTS ACCORDING TO SPECS (2)

PREPARE TEST SCHEDULE WITH DESIGNER

WRITE TEST WITH DEVELOPER AND PROVIDE CONTENT VALIDITY REVIEW

COLLECT EXISTING MATERIALS

ANALYSIS/ EVALUATION OF EXISTING MATERIALS (12)

MATERIALS APPROPRIATE? (12) YES NO

REJECT

MODIFICATION COST EFFECTIVE? (13) NO YES

(12) APPROPRIATE FOR DELIVERY SYSTEM & MANAGEMENT PLAN? YES NO

REJECT

MODIFICATION COST EFFECTIVE? (13) NO YES

WRITE REVISION INSTRUCTIONS FOR [CONTENT / MANAGEMENT / DELIVERY] CHANGES (15)

WRITE LESSON SPECIFICATIONS OBJECTIVE BY OBJECTIVE

INCLUDE REVISION OF EXISTING MATERIALS (14)

PREPARE USER INSTRUCTION

ASSEMBLE/DEVELOP INSTRUCTION ACCORDING TO SPECS (14)

WRITE MATERIAL WITH DEVELOPER & PROVIDE CONTENT VALIDITY CHECK

REVISION INSTRUCTION (15) OK? NO YES

INDIVIDUAL OR SMALL GROUP TRYOUTS OF DRAFT MATERIALS

QUALITY CONTROL CHECK (16)

NO OK? YES

REVISE

ASSEMBLE LESSONS & MODULES INTO COURSE

DEVELOP PLAN FOR INDIVIDUAL TRIAL (18)

CONDUCT TRIALS

OK? NO YES

WRITE REVISION SPECS (17)

DEVELOP PLAN FOR GROUP TRIALS (18)

CONDUCT TRIALS

NO OK? YES

ASSEMBLE COMPLETE COURSE

TO PHASE IV

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